

# Repair of chylous fistula in the neck by local muscular flaps

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## Summary

Cervical chylous fistula is an uncommon but serious complication of operative procedures in the neck. This complication is better avoided than treated, thus, the head and neck surgeon should be familiar with the detailed anatomy of the thoracic duct. The purpose of this study was to treat chylous fistulae following neck surgery after failure of conservative measures by free fat grafts and local muscular flaps. Between November 2001 and December 2004, eleven patients complaining of chylous fistula following different types of neck surgery were referred to the departments of otolaryngology and general surgery of Cairo University Hospital of Kasr Al Aini. All patients received conservative treatment before surgical repair in the form of parenteral nutrition, pressure dressings and repeated aspirations. Repair was done by identifying the site of leak and over sewing it using non-absorbable suture, or packing it with sponge gel in cases where over sewing was difficult. The site of leak was then covered with Surgicel<sup>®</sup> and a free fat graft. The free fat graft was bolstered in place with a local pedicled muscle flap. One of three muscles were used: the sternohyoid, the sternomastoid or the levator scapulae. All cases had left sided chylous fistula. Immediate closure of the fistula occurred in 4 cases while in the remaining 7 cases the fistula closed in a period varying between 2 and 5 days. Identification and suturing of the fistulous opening was possible in 4 cases and impossible in 7 cases. In all the four cases where the fistulous opening was sutured immediate stoppage of chylous leak occurred postoperatively. The superiorly based sternohyoid muscle flap was used in 3 cases, the inferiorly based sternomastoid muscle flap was used in 2 cases and the superiorly based levator scapulae flap was used in 6 cases. We concluded that the use of pedicled local muscle flaps of the neck in addition to a free fat graft offers great chances of success for closure of chylous fistulae in the neck

**Key words:** Thoracic duct- neck dissection- chylous fistula- local muscular flaps.

## Introduction

Thoracic duct injuries may result in chylous fistula, chylothorax or lymphocele (1). Cervical chylous fistula is an uncommon but serious complication of operative procedures in the neck (2). Its incidence varies from 1-2.5% ( 2 ) to 6% (3). The accumulation of chyle may raise the skin flaps and lead to necrosis of the skin with carotid exposure or even rupture. The chylous fluid may drain externally or may accumulate in the pleural cavity leading to chylothorax. Large amounts of fluids up to 4-5 L/day may be lost causing fluid and electrolyte imbalance and protein

loss. The postoperative radiation therapy may be delayed to a point where it is no longer beneficial (4). This complication is better avoided than treated, thus, the head and neck surgeon should be familiar with the detailed anatomy of the thoracic duct.

The thoracic duct originates in the abdomen as a dilated triangular structure, the cisterna chyli which collects the lymph and chyle below the diaphragm. It ascends through the thorax in the posterior mediastinum between the aorta and the azygous vein. As it enters the neck, it forms an arch, rising 3-5 cm above the

clavicle and most commonly passes anterior to the subclavian artery, the vertebral artery and vein and the thyrocervical trunk or its branches. It is also anterior to the phrenic nerve and medial border of the scalenus anterior muscle but separated from them by the prevertebral fascia. The carotid artery, vagus nerve and internal jugular vein are situated usually in front of the duct as it arches upward, forward and laterally to open in the angle formed by the junction of the left subclavian vein with the left internal jugular vein (Figs.1&2) (2). There are many anatomic variations in the course of the duct, particularly in its terminal portion. The commonest is that it may end in the left internal jugular vein either as a single termination, or less commonly by multiple terminations. In some instances the thoracic duct does not join the internal jugular vein but venous connections are made with the subclavian, innominate and external jugular veins (5). In less than 5% of cases the thoracic duct may open in the right side (6). In addition to these anatomic variations, the area of the root of the neck may be destroyed by disease, infection, radiation or previous surgery. This further renders dissection in this area difficult (7). The right lymphatic duct which drains the right side of the head, neck, the right upper extremity, the right lung, the right side of the heart and the convex surface of the liver ends in the right subclavian vein at its junction with the right internal jugular vein ( Fig.3). Both the thoracic duct and the right lymphatic duct have valves at their ends to prevent retrograde flow of blood into the lymphatic system (2).

The word chyle is derived from the Latin *chylus* meaning juice. It is made up of lymph and emulsified fat. Seventy percent of the ingested fat takes the chylous route to the blood stream. Chyle contains 2-4.5% protein and the electrolyte composition is similar to that of lymph and plasma. The main lipid content is triglyceride. Chyle flow rate may be as high as 2-4 L/day. Leucocytes range from

1000-20000/cc and are predominantly lymphocytes (2,8).

The purpose of this study was to treat surgically chylous fistulae following neck surgery after failure of conservative measures by free fat grafts and local muscular flaps.

### **Material and Methods**

Between November 2001 and December 2004, eleven patients complaining of chylous fistula following different types of neck surgery were referred to the departments of otolaryngology and general surgery of Cairo University Hospital of Kasr Al Aini. All patients received conservative treatment before referral in the form of parenteral nutrition, pressure dressings and repeated aspirations. Surgical repair of the fistula was decided when the amount of chyle drainage exceeded 500cc/ 24 hours for more than four days as indicated by Crumely and Smith in 1976 (2).

The patient is given full cream milk two hours before surgery to help identifying the fistulous opening. He is placed in the Trendelenburg position, and under general anesthesia, the fistula was explored via the previous neck incision and the wound filled with saline. The anesthesiologist was asked to apply prolonged positive pressure to identify the site of the leak. The creamy chyle was identified as it rises in the clear saline and the leaking point is identified and sutured with 3.0 silk sutures. The sutures were covered by absorbable hemostat (Surgicel<sup>®</sup>, Ethicon, Inc., NJ, USA) and a free fat graft harvested from the submental region or abdominal fat was sutured to the periosteum of the clavicle and deep neck musculature using 2.0 Vicryl sutures. This technique was only possible in four cases and in the remaining seven cases attempts to oversew the area of leak were unsuccessful because the friable tissue surrounding the leak did not hold the suture material. In these cases, the area was packed with gelatin sponge (Curaspon<sup>®</sup>,

Curamedical, Amsterdam, The Netherlands), then covered with Surgicel<sup>®</sup> and fat as described before.

The free fat graft was bolstered in place with a local pedicled muscle flap. The muscle used depended upon the available muscles in the field after the original resection. One of three muscles were used: the sternohyoid, the sternomastoid or the levator scapulae.

The sternohyoid muscle of the side of the fistula was pedicled superiorly and cut near its sternal end then rotated laterally to cover the fat graft, being fixed by 2.0 Vicryl sutures to the periosteum of the clavicle and deep muscles of the neck (Fig.4) in three cases.

The sternomastoid muscle was used in two cases where the strap muscles of the neck were not available (one case of thyroid papillary carcinoma with removal of the covering strap muscles and another case of car accident with fractured cervical spine and performance of cervical spine fixation through anterior cervical approach in a small town's hospital). The clavicular fibres of the muscle were divided near the middle of the muscle and an inferiorly based muscle flap was turned to cover the fat graft. It was fixed to the deep neck muscles using 2.0 Vicryl sutures (Fig.5)

In six cases the strap muscles of the neck and the sternomastoid muscle were removed as part of the original surgical procedure (Total laryngectomy or laryngopharyngoesophagectomy with radical neck dissection). The levator scapula was then used. The muscle was elevated by blunt finger dissection and cut near its insertion being pedicled superiorly, then rotated medially to cover the fat graft and fixed by 2.0 Vicryl sutures to the periosteum of the clavicle and deep muscles of the neck (Fig.6,7).

Suction drains were placed and the wound closed. Low-fat regimen was followed after surgery. The drains were removed when no chyle was coming out through the drains.

## Results

This study included 11 cases, 10 males and one female with a mean age of 48 years ( $\pm 15$  years, range: 23 - 68 years). All cases had left sided chylous fistula. The duration of the chylous fistula before surgical repair was of a mean period of 10 days ( $\pm 5.7$  days, range: 5 - 25 days). Immediate closure of the fistula occurred in 4 cases while in the remaining 7 cases the fistula closed in a period varying between 2 and 5 days giving a mean delay of closure of 2 days ( $\pm 1.9$  days, range: 0 - 5 days). Identification and suturing of the fistulous opening was possible in 4 cases and impossible in 7 cases. In all the four cases where the fistulous opening was sutured immediate stoppage of chylous leak occurred postoperatively. The superiorly based sternohyoid muscle flap was used in 3 cases, the inferiorly based sternomastoid muscle flap was used in 2 cases and the superiorly based levator scapula flap was used in 6 cases. Table 1 shows the details of the demographic data of the patients, the type of original surgery, the duration of fistula before repair, the type of muscular flap used, the ability to identify and suture the fistula and the duration of leak after repair.

## Discussion

Chylous fistula is defined as the presence of lymph in the postoperative closed wound suction drainage (9). Chylous fistula was a fatal complication (about 12.5% mortality) at the beginning of the 1900s (2). Currently it is rare but it is a potentially serious complication that may increase the local or systemic morbidity rates. Local cutaneous reactions such as induration, edema, erythema and incisional problems occur due to the alkaline pH of the chyle or the vasoactive substances released by lymphocytes. Systemic problems are due to disturbances in lipid, protein, or electrolyte metabolism or loss of the lymphocytes (3).

Prevention of chylous fistula is easier and even more effective than any of

the treatments (7). Thorough knowledge of the relevant lymphatic anatomy and its variations is essential to avoid injury to the thoracic duct and its tributaries. If chyle leakage is encountered intraoperatively, it is important to be dealt with (8).

When postoperative chylous drainage occurs, all authors agree that an initial trial of conservative management is appropriate. Various measures that may facilitate closure of the fistula include: bed rest with head elevation, continuation of closed drainage and dietary management to decrease the rate of chyle formation either through the use of total parenteral nutrition or enteral feeding using medium-chain triglycerides as the only fat source, pressure dressings and repeated aspirations (1,2,8).

The grouping of chylous fistulae into a high-output (>500mL/24 h) or a low-output (<500mL/24 h) for 4 days was first suggested by Crumley and Smith in 1976(2). They stated that low-output fistulae tended to respond to conservative measures, whereas high-output fistulae were refractory to conservative treatment and required reoperation for definitive repair. Other authors recommend proceeding with indicated reoperative repair without delay, because as time passes, progressive granulation tissue in the wound can obscure the surrounding anatomy complicating repair techniques and decreasing the chance for success (7,8,10).

In the present series of patients, all cases had high-output already established chylous fistulae that did not respond to conservative treatment prior to their referral. All cases had left sided fistulae due to injury of the thoracic duct or its tributaries. Although right sided fistulae were described in the literature due to injury of the right lymphatic vein or abnormal thoracic duct ending in the right side of the neck (2,8) yet this was not encountered in this series. Nine out of the eleven patients in this series were subjected to neck dissection (8 radical and

one functional). The incidence of thoracic duct injuries after neck dissection varied in the literature between 1 to 6% (1).

Surgical re-exploration in the Trendelenburg position after a high fat diet using positive pressure under general anesthesia (1,8,10) or Valsalva under local anesthesia (2) revealed the site of leak. In the present study we preferred the technique under general anesthesia, and, although the site of leak was apparent in all cases, yet placing sutures over the site of the leak was only possible in four cases with a fistula of less than one week duration. In the remaining seven cases this was impossible due to friability of the surrounding tissues. One of these seven cases (case number 8) had a fistula of less than one week but was treated by a radical dose of radiotherapy for nasopharyngeal carcinoma. The primary responded to radiotherapy but the nodes were resistant and a radical neck dissection was performed. When the surrounding tissue was friable and unsuitable for sutures, packing the site of the fistula with gelfoam seemed to be the fitting solution for this problem. Whether sutures were possible or gelfoam packing was used, the site of the fistula was covered by Surgicel as advocated by many authors (9,11).

Importing a free fat graft from the submental area as advocated by Casler and Brietzke in 1998 (10) or abdominal fat as Nouwen et al. in 2004 (1) was used in the present study as an additional coverage. It is not understood why fat is successful in closing chylous leak. A review of the literature has revealed no definitive link, on a molecular level, between lipids and adipose tissue and chyle coagulation. However, the use of a free fat graft offers the surgeon an additional option in the management of this difficult problem (10).

In the present study, the final step for repair of chylous fistula was the use of a pedicled local muscular flap. Three muscles were available at the surgical field. First the sternohyoid muscle flap. This flap was successfully used by Casler

and Brietzke for repair of a high output chylous fistula (10). In the present study it was successfully used in three cases with stoppage of drainage after a period of 2 to 5 days postoperatively. The maximum period of 5 days occurred in a patient who received a radical dose of radiotherapy preoperatively for anaplastic carcinoma of the nasopharynx. This flap has the advantage of being readily available in the surgical field and easily fashioned.

The sternomastoid muscle passes obliquely down across the side of the neck and forms a prominent landmark (12). An inferiorly based flap was used in two cases when the sternohyoid muscle was resected for a papillary carcinoma of the thyroid adherent to the infrahyoid muscles, or far from the incision as a case who had the fistula after a resection of a cervical rib. This flap was used successfully by Nouwen et al. in a report of one case (1).

In six cases of the present series, the larynx was removed with the infrahyoid muscles, with associated neck dissection with resection of the sternomastoid muscle. In these cases, the levator scapulae muscle was used as a superiorly based pedicled flap. Following radical neck dissection, it forms part of the floor field lying deep to the deep cervical fascia (13). The levator scapulae muscle flap was described for carotid protection by Grady et al in 1956 (14). Staley's modification in 1961 involved freeing the muscle posteriorly and inferiorly then anterior rotation over the artery based on the belief that the blood supply comes from the anterior edge of the muscle (15). In 1966 Gacek and Zonis described mobilizing the entire levator scapulae being attached superiorly(16).

The use of the levator scapulae muscle flap was then extended to involve reconstruction of different defects of the head and neck as the floor of the mouth, tongue and oropharynx (13,17). On reviewing the literature, we did not find any reports concerning the use of the levator scapulae muscle flap for repair of

chylous fistulae. In the present study, the use of muscle flap as an addition to the free fat graft and other closure techniques as non-absorbable sutures, Gelfoam® or Surgicel® decreased the period of drainage after surgical repair of the fistula to an average of two days, compared to a period varying from 11-28 days in studies not using muscle flaps for additional coverage, especially if the fistulous opening was difficult to ligate (8). Other authors used pectoralis major flap and fibrin glue. They stated that due to denervation, the flap will atrophy to a great extent leaving minimal cosmetic deformity in the neck (18). In none of our cases we resorted to a pectoralis major flap. In our opinion it is more time consuming and not necessary in these conditions especially with the availability of other local usable muscles. On the other hand, it might be needed in cases of failure of the local muscle flaps to close the fistula.

### **Conclusion**

The use of pedicled local muscle flaps of the neck in addition to a free fat graft offers great chances of success for closure of chylous fistulae in the neck, especially when the fistulous opening was difficult to ligate and the site of leak was only packed with sponge gel or Surgicel® .

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Table 1: Summary of cases

Case	Age (years)	Sex	Type of surgery	Period of leak (days)	Type of muscle flap used	Site of fistula sutured	Delay of leak after repair (days)
1	24	M	Anterior approach to cervical spine	25	SM	NO	5
2	64	M	Total laryngectomy & left radical neck dissection	5	LS	YES	0
3	23	F	Total laryngopharyngoesophagectomy, stomach pull-up & left radical neck dissection	8	LS	NO	2
4	45	M	Total parotidectomy & left radical neck dissection	10	SH	NO	2
5	43	M	Cervical rib resection	12	SH	NO	3
6	38	M	Total thyroidectomy & left functional neck dissection	7	SM	YES	0
7	68	M	Total laryngectomy & left radical neck dissection	7	LS	YES	0
8	47	M	Radiotherapy for nasopharyngeal carcinoma & left radical neck dissection	5	SH	NO	5
9	62	M	Total laryngectomy & left radical neck dissection	14	LS	NO	3
10	55	M	Total laryngectomy & left radical neck dissection	7	LS	YES	0
11	58	M	Total laryngectomy & left radical neck dissection	10	LS	NO	2

M: Male F: Female SH: Sternohyoid SM: Sternomastoid LS: Levator scapulae

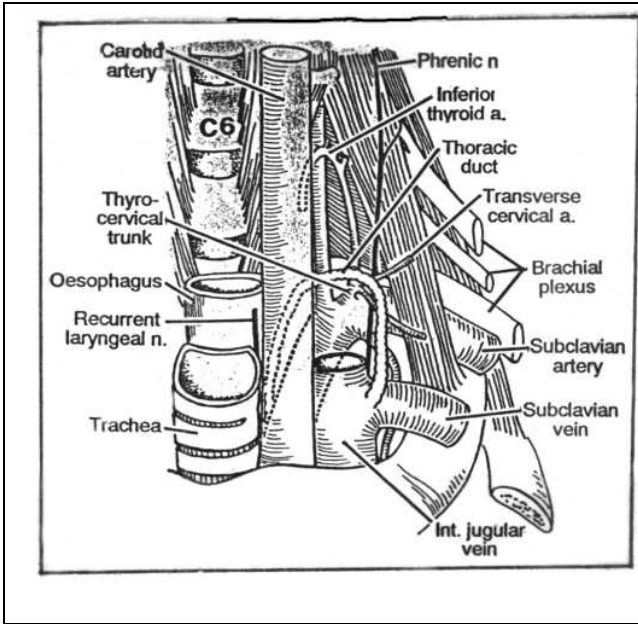


Fig.1 Relations of the thoracic duct at the root of the left side of the neck (after Gregor, 2000)

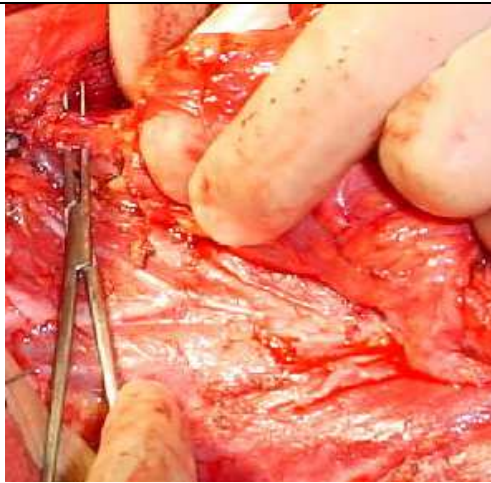


Fig.2 thoracic duct at the left side of the neck

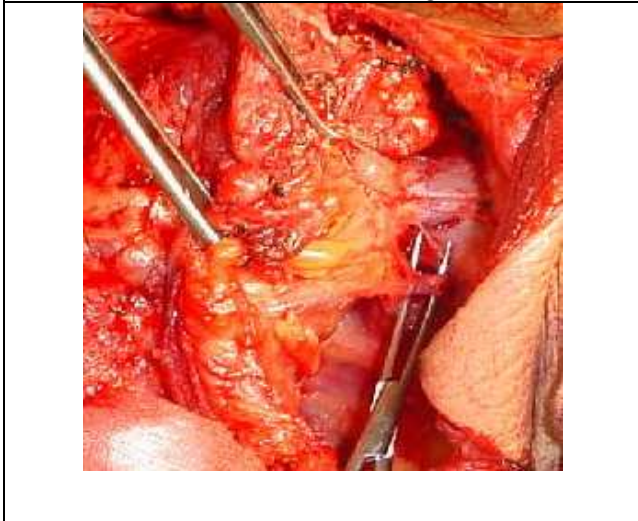


Fig.3 Right lymphatic duct

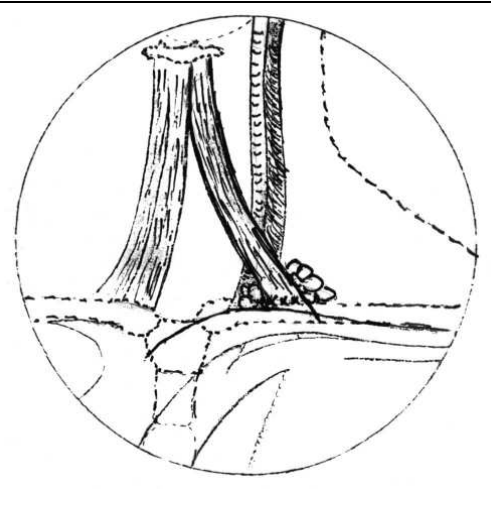


Fig. 4 The sternohyoid muscle flap bolstering the free fat graft (after Casler and Brietzke, 1998)



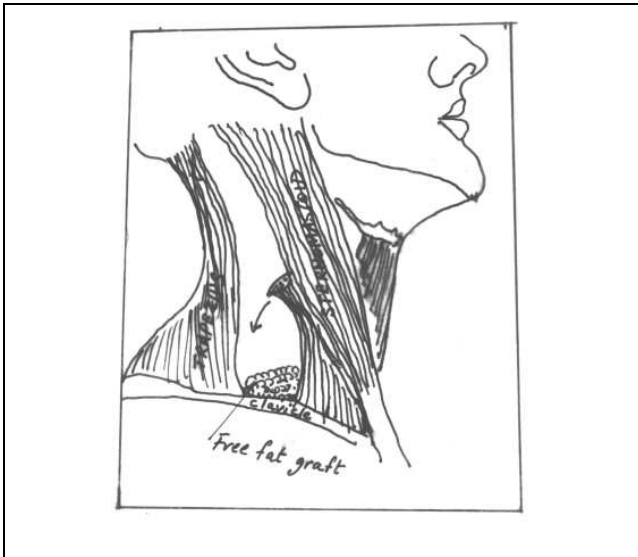


Fig.5 The sternomastoid muscle flap



Fig. 6 finger dissection of the levator scapulae



Fig.7 The levator scapulae placed over the free fat graft

